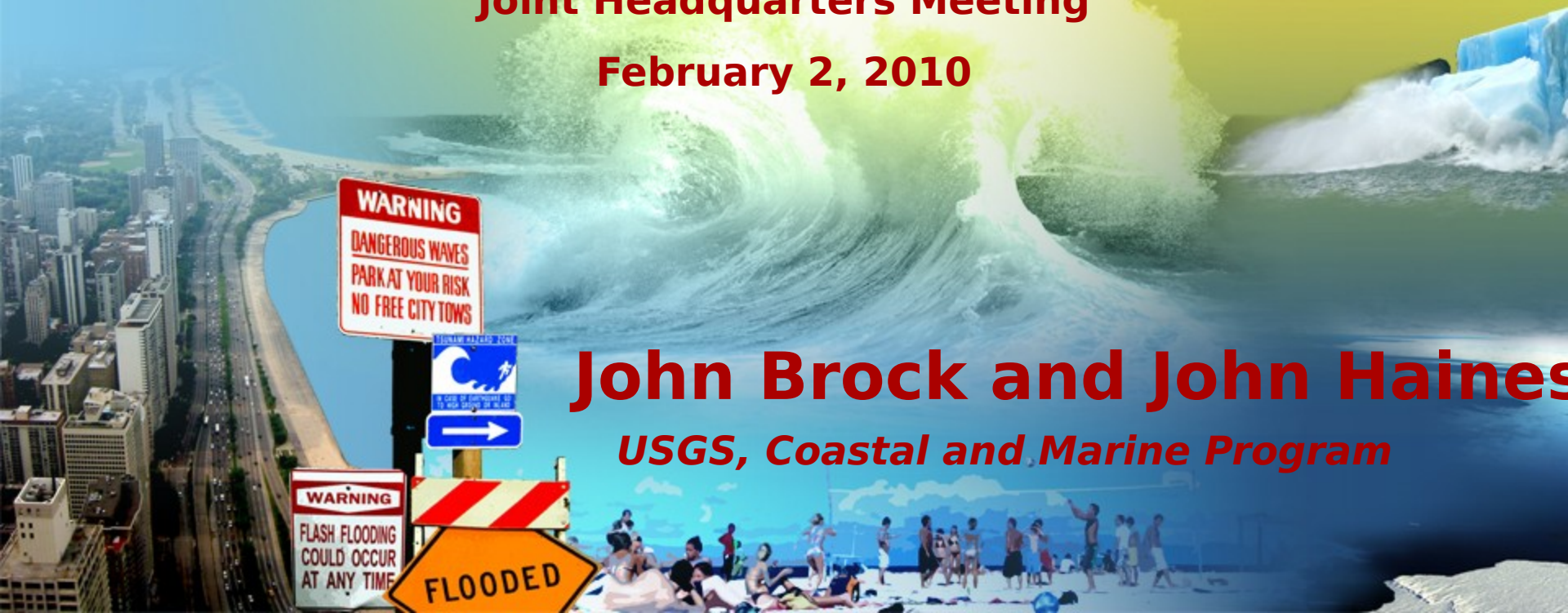
Coastal Vulnerability Index and USGS – NOS Cooperation on Coastal Lidar Mapping

U.S. Geological Survey – U.S. Army Corps of Engineers – National Ocean Service

Joint Headquarters Meeting

February 2, 2010

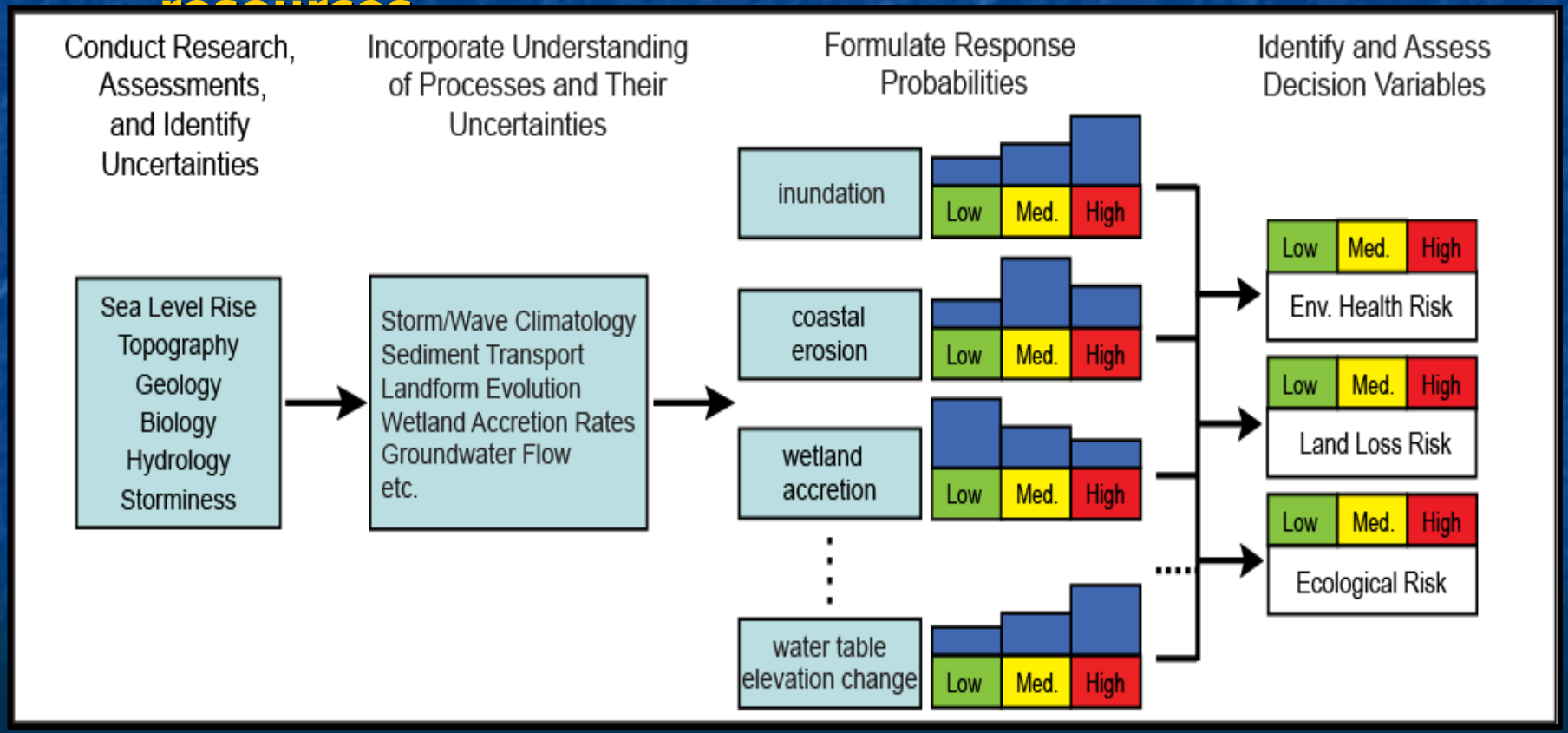


John Brock and John Haines

USGS, Coastal and Marine Program

USGS: Science for Decision-making in response to Sea-Level Rise

- Explicitly including uncertainty
- Explicitly including management application
- Extracting information from data/information resources



USGS

Complex Systems + Complex Responses
⇒ Comprehensive, Integrated Research

- Multiple (human and natural drivers) spanning multiple time scales

- Diversity of systems – glaciated coasts to tropical atolls, wetlands, and barriers responding dynamically

- Observations – Research – Modeling

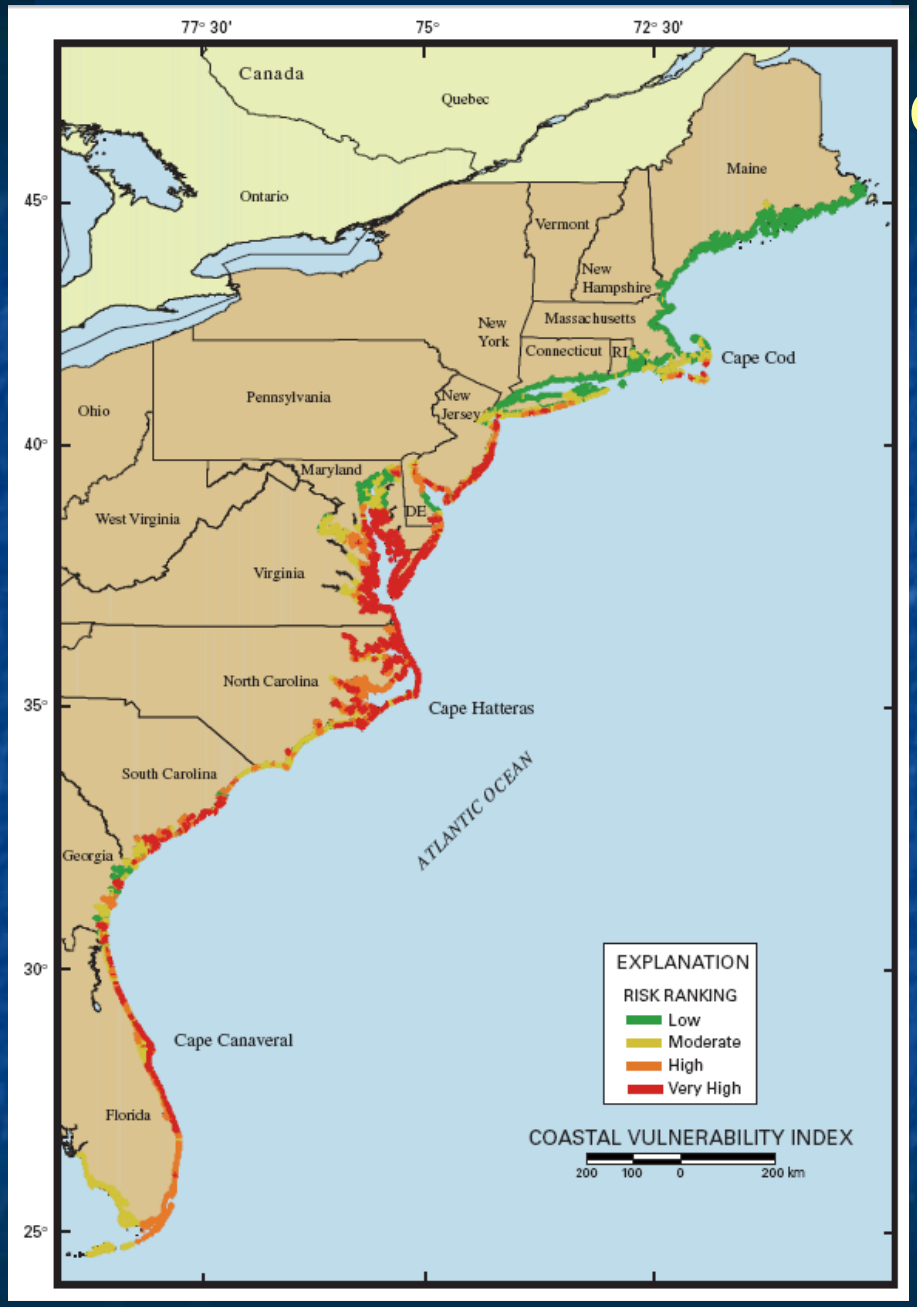
- Needs span policy/management scales – National and Regional

- Mode

USGS

Input Data: Coastal Vulnerability Index

(Thieler and Hammar-Klose, 1999)



Utilized existing data for six geological and physical process variables (~ 8km grid):

a) Geomorphology
b) Historic shoreline change
c) Coastal slope
d) Relative sea-level rise rate
e) Mean sig. wave height
f) Mean tidal range

Solve this differential equation?

d(state)/dt = funct. (geomorphology, wave-climate, sea level, etc.)

OR, solve this probabilistic version

USGS

A Schematic of the Process

Required Input

LIDAR OBS

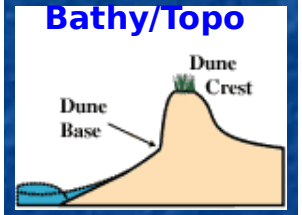
Area for collaboration: prioritize national observation resources to provide accurate and up-to-date elevation data

Evaluate output

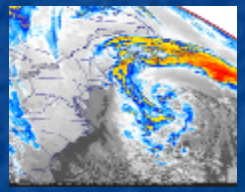
LIDAR OBS

Area for collaboration: prioritize national observation resources to minimize uncertainty

Bathy/Topo

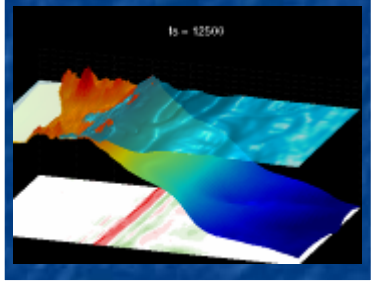


Weather

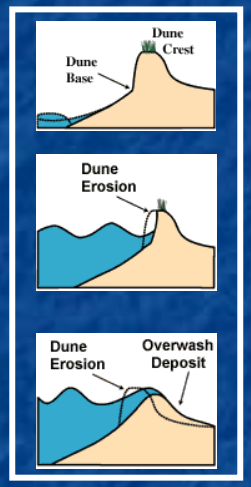


Observations

Overwash and Erosion models

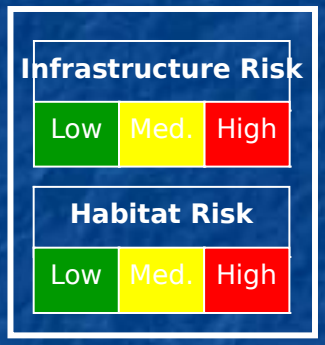


Processes



Response

Probability



Risk Analysis

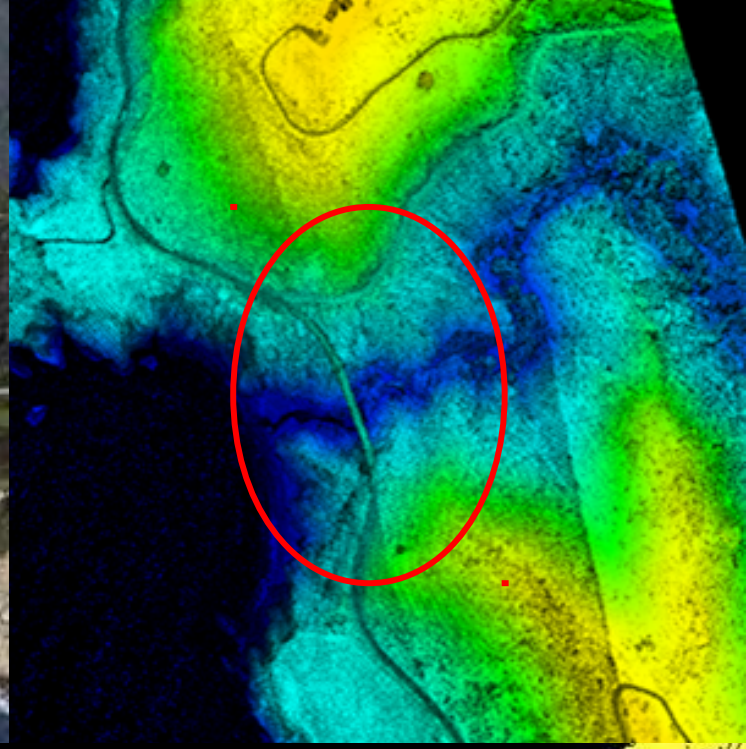
wave/water OBS

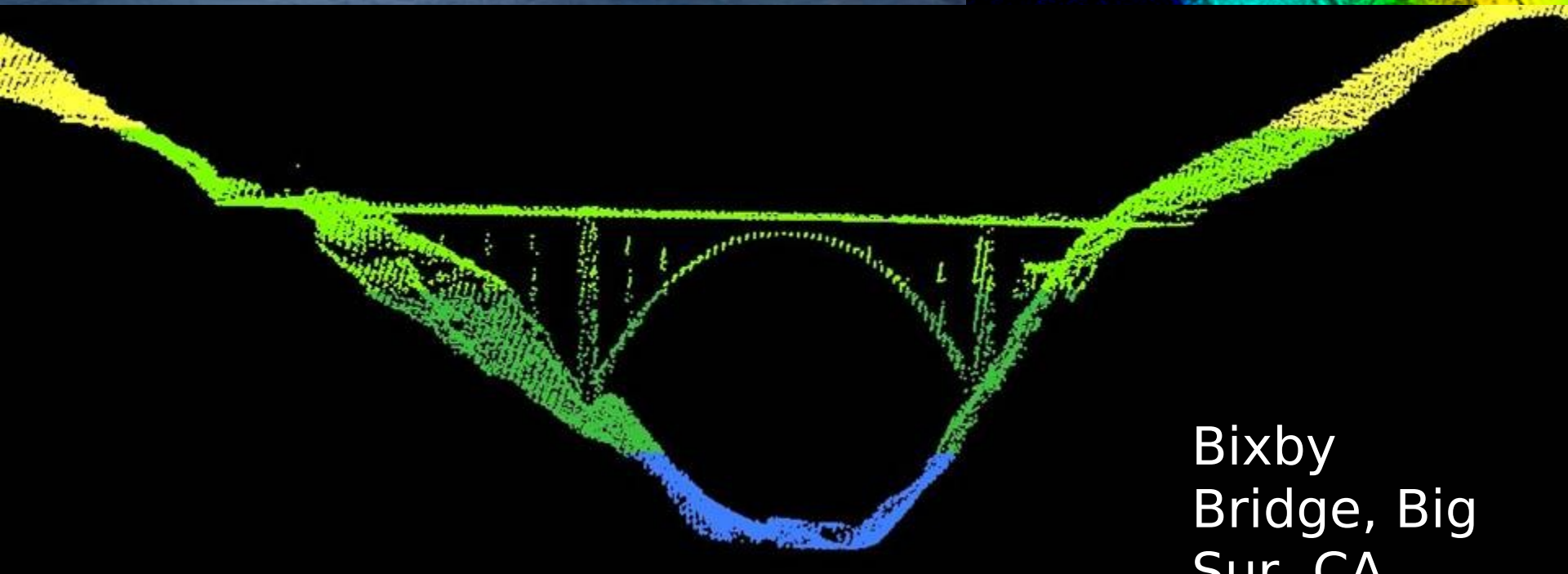
wave/water MODELS

Areas for collaboration

1. Nested modeling using national observation resources and large scale models to support high resolution models—we need accurate Boundary Condition inputs
2. Scenario exploration for likely climate changes and extreme storms

An Emerging NOS – USGS Collaboration on Lidar Coastal Mapping

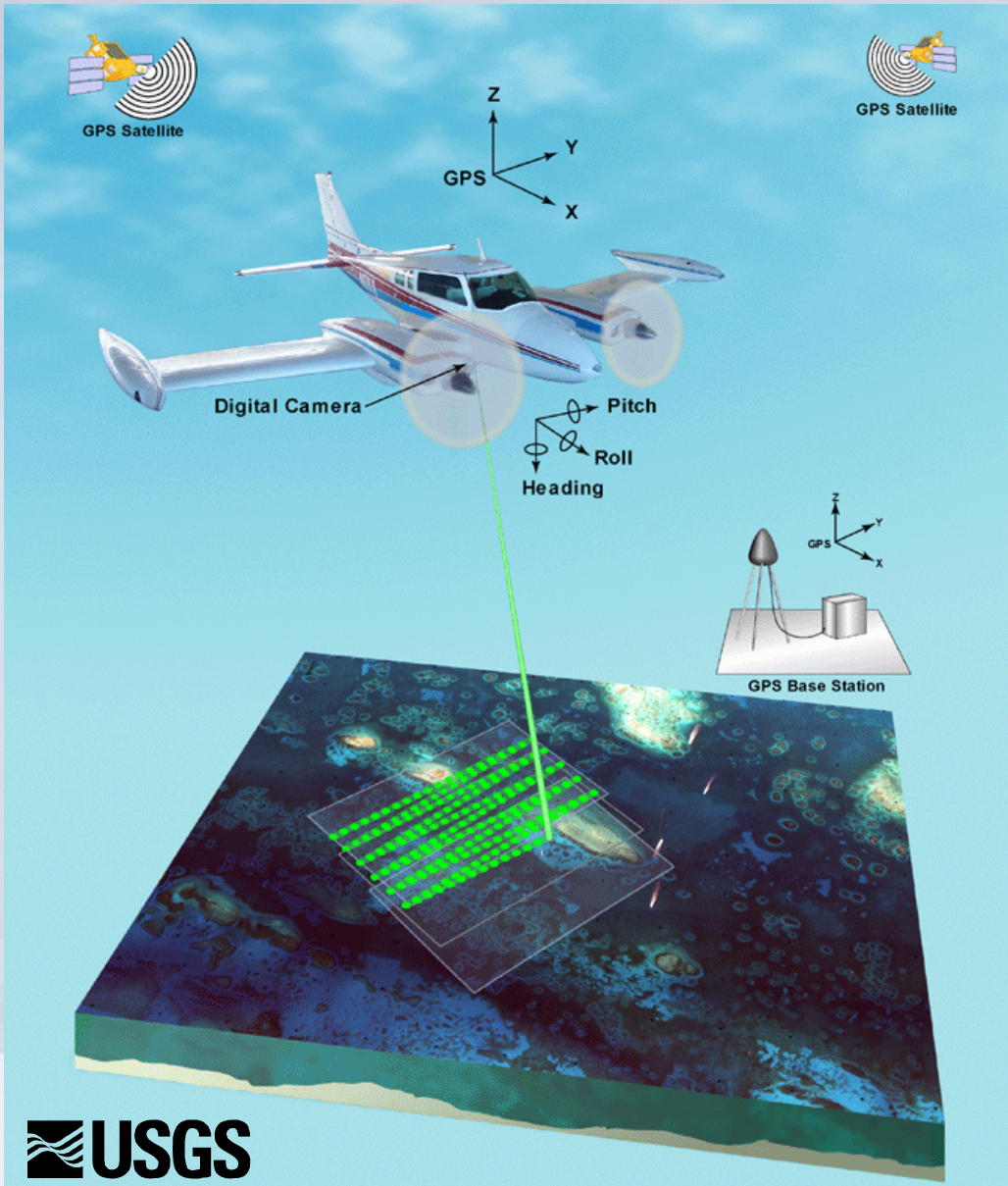




Bixby Bridge, Big Sur, CA

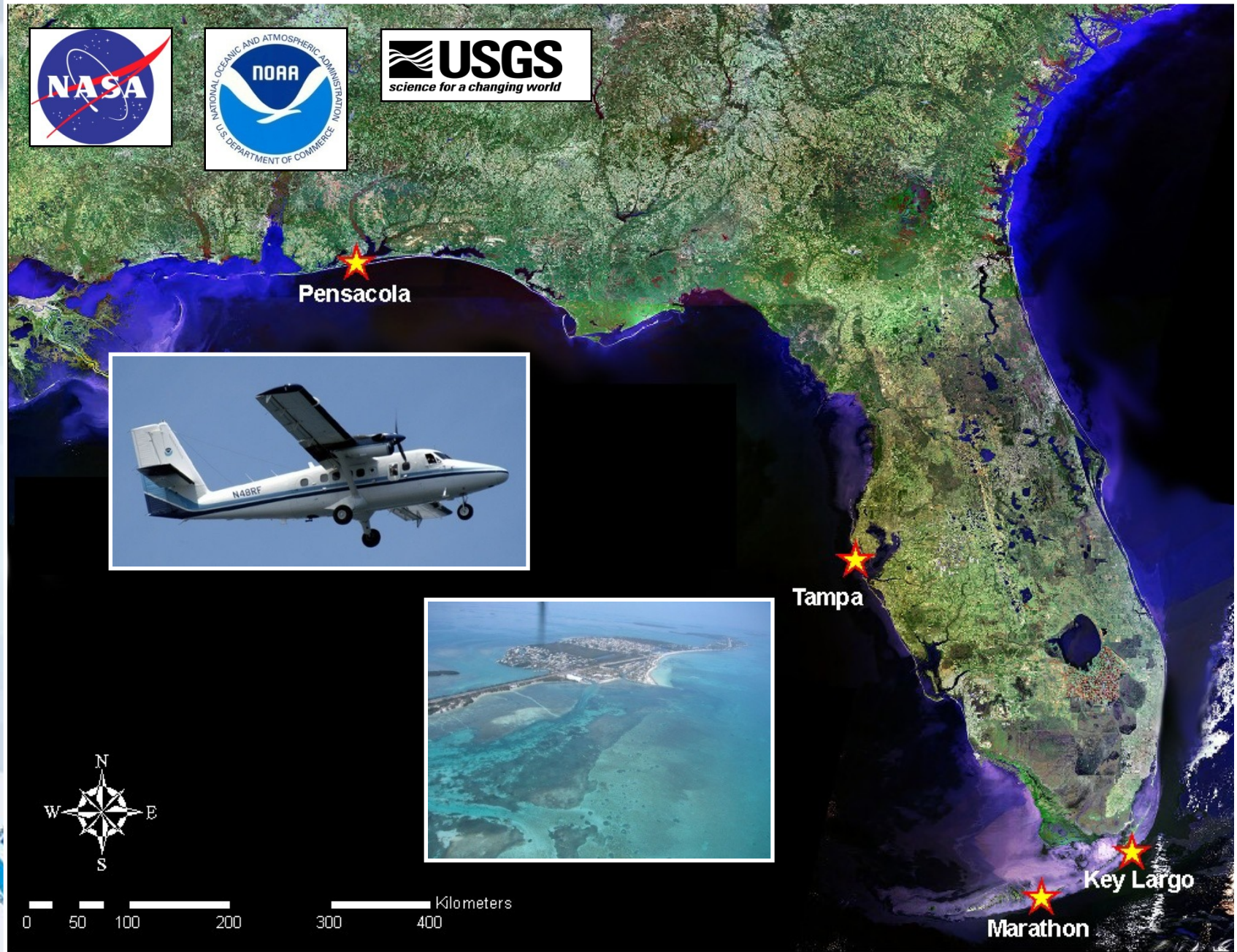
2004 NOAA-NASA-USGS Collaboration: EAARL Demo Project

- **NOS RSD evaluated the EAARL for use in NOAA/NOS mapping programs:**
  - **Shoreline mapping**
  - **Nautical charting (near-shore bathymetry)**
  - **Coral reef mapping**
  - **Emergency response (e.g., post-disaster damage assessment projects**

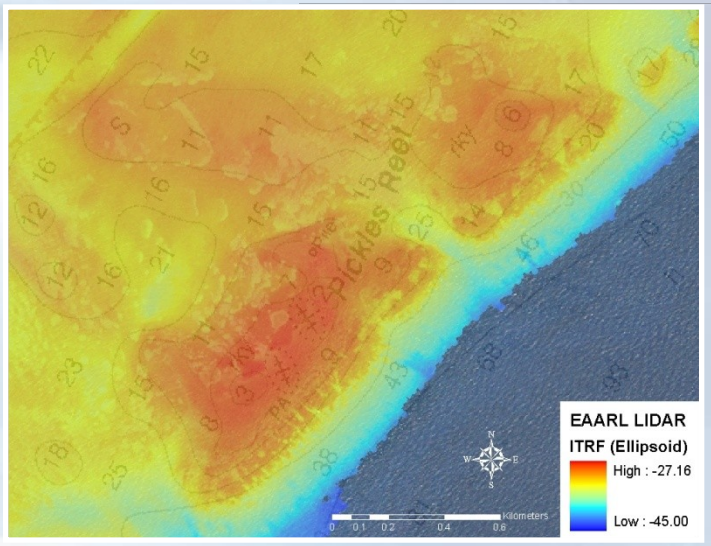


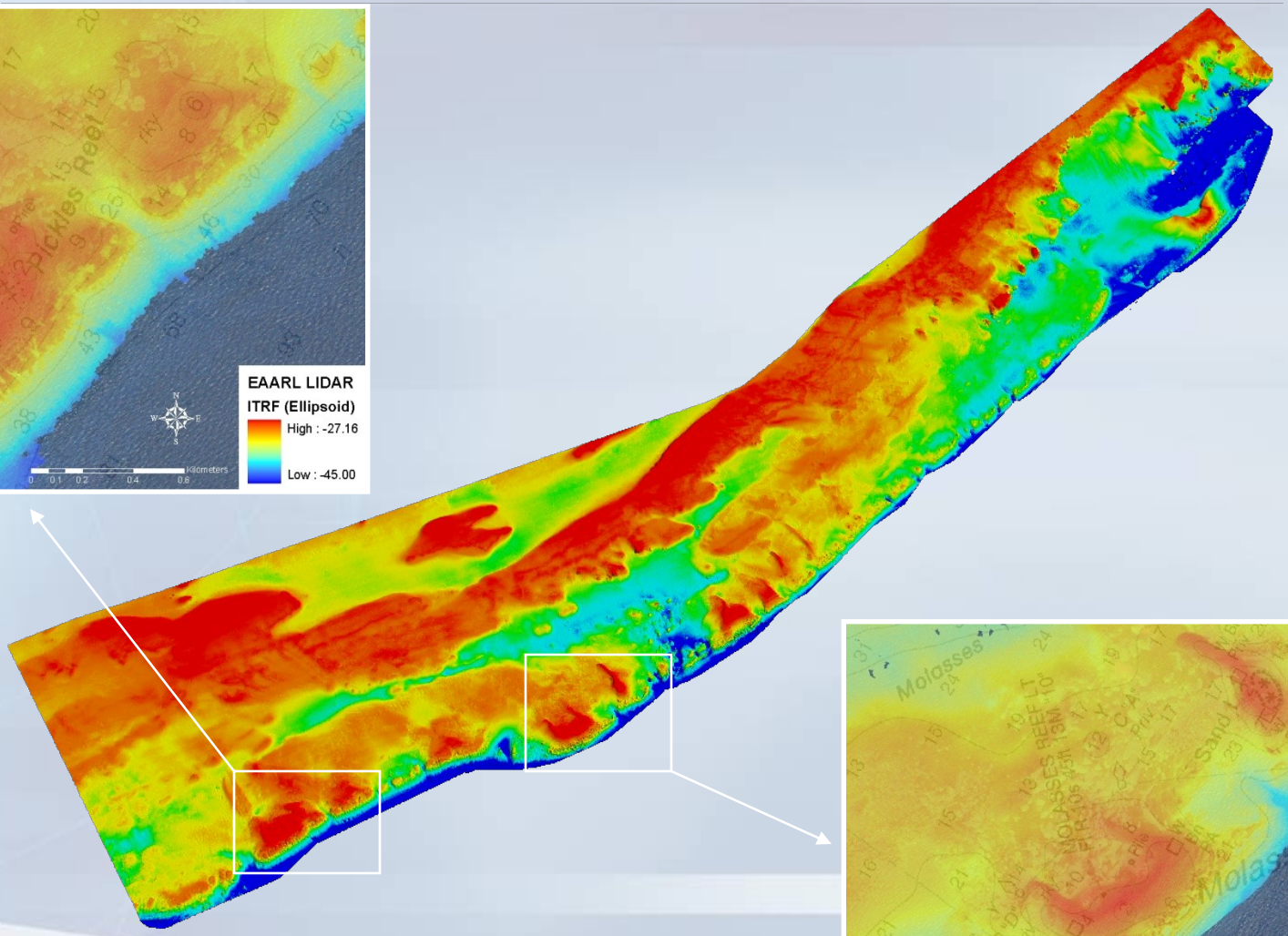
National Oceanic and Atmospheric Administration

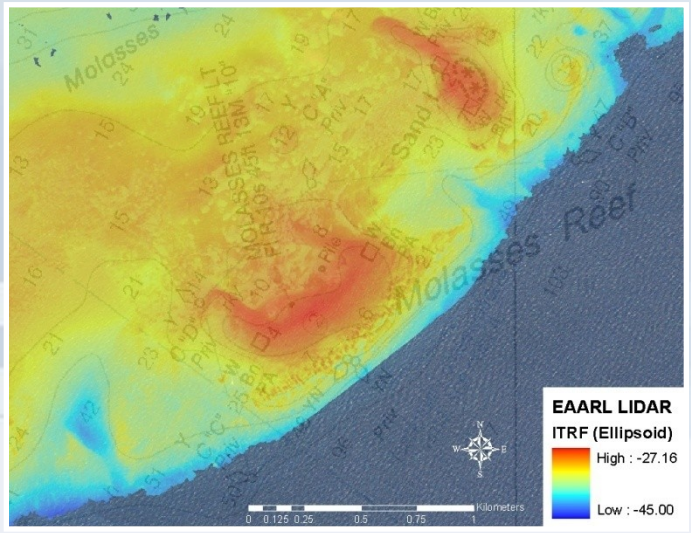
2004 Collaborative EAARL Demo Project:



The EAARL Project: Florida Keys



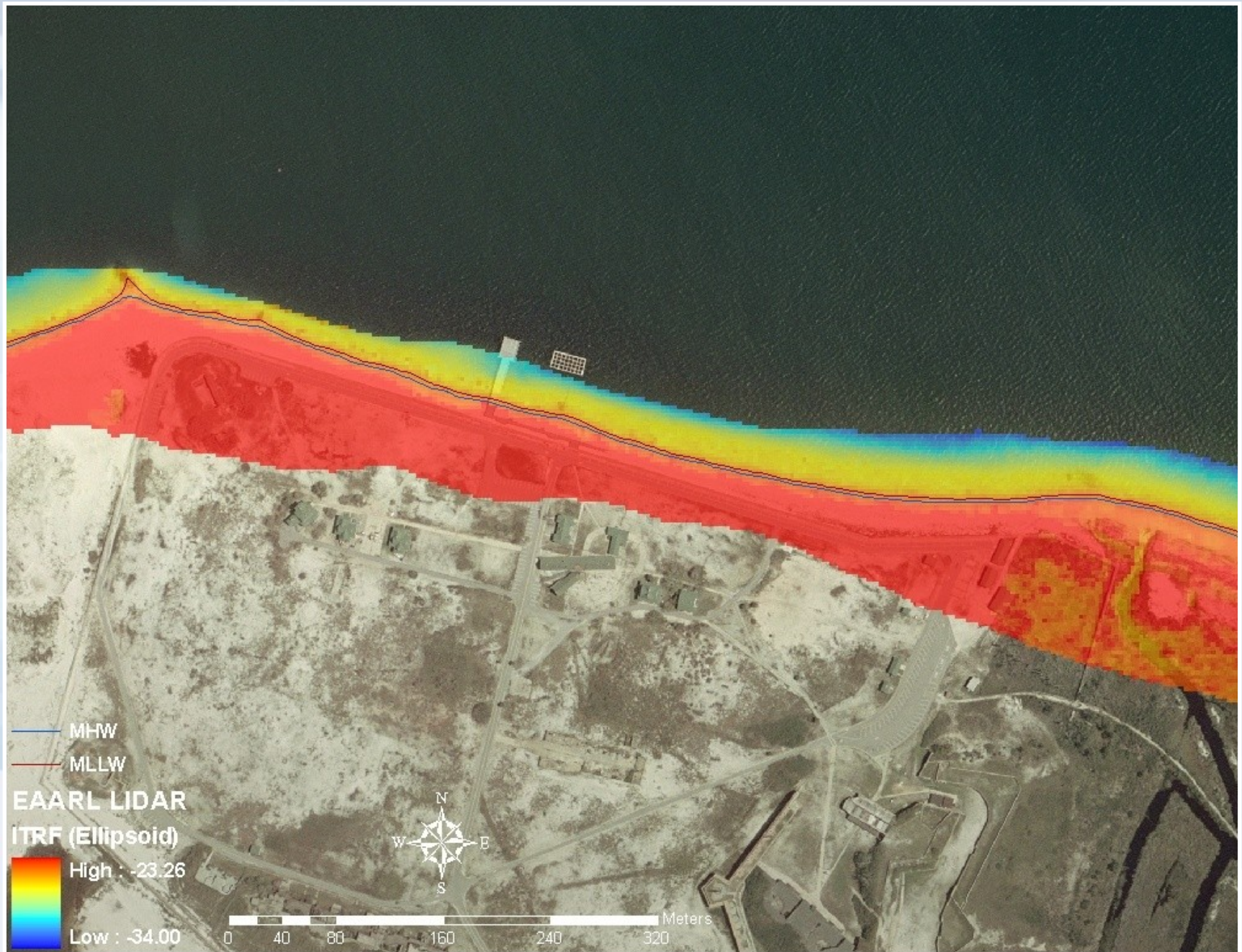




National Oceanic and Atmospheric Administration

USGS

The EAARL Project: Shoreline Extraction (Pensacola)



The EAARL Project: Shoreline Extraction (Pensacola)

EAARL 2004 Demo: Shoreline Extraction (Tampa)

National Oceanic and Atmospheric Administr

2004 EAARL Demo Project - Main Finding:

- EAARL is nearly ideal sensor for NOAA coastal mapping
  - Map multiple tidal-datum-based shorelines (e.g., MHW, MLLW) without tide coordination

    => Big increase in efficiency!
  - Topography and shallow-water bathymetry from a single data collect
    - Can fill in the shallow-water gap in current hydro, caused by the NALL line
    - Support storm surge modeling and coastal science applications
    - Supports (and benefits from) VDatum
  - Coral reef mapping
  - Meet multiple project and program needs simultaneously
    - IOCM: map once – use many!

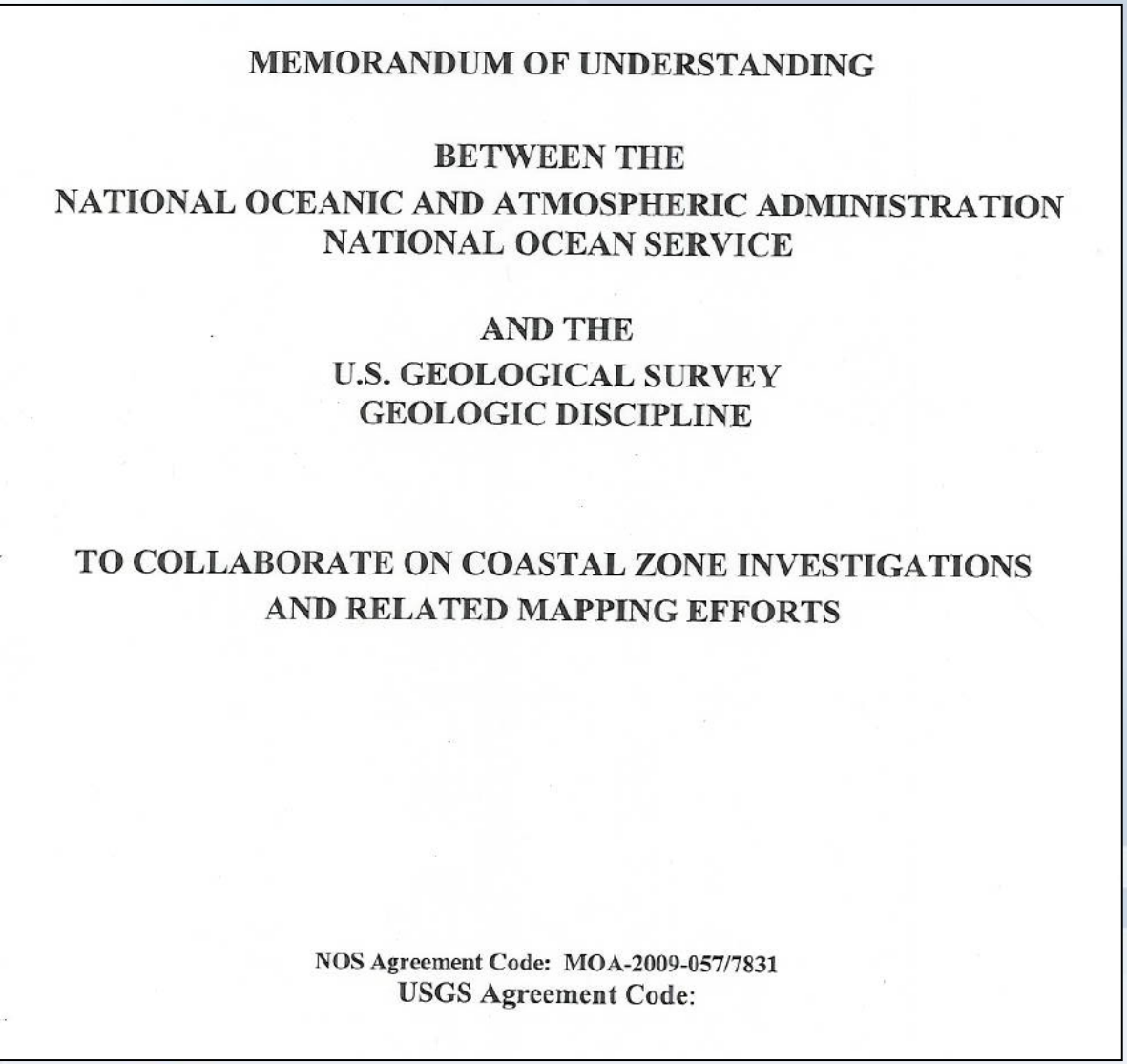
Next Steps in USGS-NOAA EAARL Collaboration:

A 2nd EAARL system currently being built by USGS

Plan to fly on a new NOAA aircraft, a King Air 350 (N68RF)

We are currently working together to optimize the system for this aircraft and to ensure mutually-beneficial data

Authority for Collaboration:



MEMORANDUM OF UNDERSTANDING

BETWEEN THE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL OCEAN SERVICE

AND THE
U.S. GEOLOGICAL SURVEY
GEOLOGIC DISCIPLINE

TO COLLABORATE ON COASTAL ZONE INVESTIGATIONS
AND RELATED MAPPING EFFORTS

NOS Agreement Code: MOA-2009-057/7831
USGS Agreement Code:

- 2 recent MOUs: 2009-057/7831 & NOAA-USGS MOU2-05
- "The primary objective of this partnership is to cooperate on a variety of technological advancements that may include airborne LiDAR bathymetry and other coastal mapping imaging and charting technologies."
- "The purpose of this MOU is to establish a framework for cooperation and coordination between the USGS and NOAA…in addressing the Nation's physical, biological, and ocean science needs."